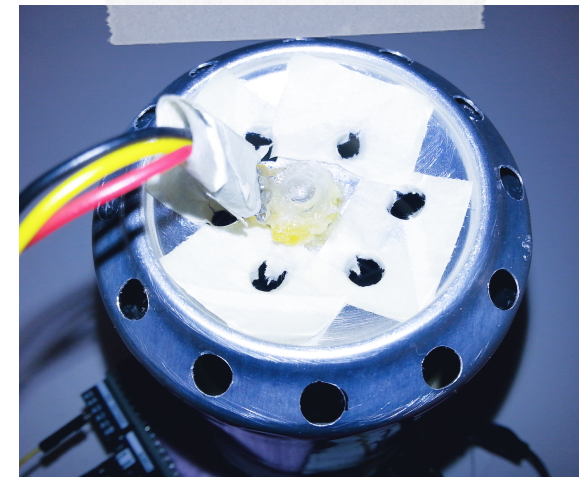




Encasement. We cut the top off of a soda can (\$1) and used it to provide protection and insulation to the hair dryer heating elements. The soda can creates the chamber in which the hot air moves through and heats the PCR tubes. The soda can is ideal because it is made of aluminum which is the ideal material to work with considering it is cheap, light weight (for better portability), and ductile so that it is easily modified for our uses.

Holder. We symmetrically drilled holes into the bottom of the soda can for the PCR tubes to sit in along with evenly spaced holes along the perimeter of the can bottom to provide air ventilation. This ventilation is extremely important in order to prevent the machine from getting too hot too quickly and getting out of control. The autoclave tape seen in the picture was used for making the tubes sit snugly in the holes and avoid being blown out by the constant airflow from the fan.





Sensing. We used an LM35 temperature sensor (\$2) submerged in a tube of mineral oil to provide feedback to the Arduino. We submerged it in mineral oil in a PCR tube in order to best detect the actual temperature of the PCR reaction solution inside the tubes.

Insulation. The mica sheet was one of the parts that came with the hair dryer and it acts as a barrier between the soda can and heating elements of the hair dryer while also providing increased insulation to the heating chamber. The increased insulation helps prevent excess heat from escaping the system, making the machine more efficient for heating. Mica is also the ideal material as it can withstand high temperatures and the air temperature inside the can greatly exceeds the 95°C needed for the PCR reaction.



Heating. The main power horse of the PCR machine is the hair dryer (\$25) which heats the chamber via nichrome wires that wrap around the main structure of the hair dryer. Nichrome wire is an ideal material to use because it has a very high resistance to oxidation and can therefore be heated to extremely high temperatures, allowing for a fast PCR reaction. The arrangement of the wires evenly dissipates heat which is ideal for



Cooling. The fan, also from the original hair dryer is integral to the cooling of the temperature for the annealing phase of PCR. The fan provides constant airflow through the chamber pushes out the hot air and also supplies new air to the system. It is also very important in keeping the whole machine from overheating as the nichrome wire is able to reach dangerously high temperatures.